SOLAR OBSERVATIONS

SOLAR AND SKY RADIATION MEASUREMENTS DURING DECEMBER, 1928

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For a description of instruments and exposures and an account of the method of obtaining and reducing the measurements, the reader is referred to the REVIEW for January, 1924, **52**:42; January, 1925, **53**:29, and July, 1925, **53**:318.

Table 1 shows that solar radiation intensities averaged slightly below normal values for December at Washington, D. C., and Lincoln, Nebr. At Madison, Wis., but few measurements were made.

Table 2 shows that the total solar radiation received on a horizontal surface directly from the sun and diffusely from the sky was below the December normal at the three stations for which normals have been determined. For the year the total received was slightly below the annual average for the respective stations.

Skylight polarization measurements, made at Washington on three days, give a mean of 56 per cent, with a maximum of 60 per cent on the 11th. These are slightly below the corresponding average values for Washington in December. At Madison no measurements were obtained during the month, as most of the time the ground was covered with snow.

TABLE 1.—*Solar radiation intensities during December, 1928*

[Gram-calories per minute per square centimeter of normal surface]

Washington, D. C.

Date	Sun's zenith distance										
	8 a.m.	78.7°	75.7°	70.7°	60.0°	0.0°	60.0°	70.7°	75.7°	78.7°	Noon
	75th mer. time	Air mass									Local mean solar time
		A. M.					P. M.				
	e.	5.0	4.0	3.0	2.0	[1]1.0	2.0	3.0	4.0	5.0	e.
	mm.	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*mm.*
Dec. 3	5.16				1.07			0.90			6.27
Dec. 4	4.37			0.98	1.26						4.17
Dec. 5	6.76			1.19	1.31						3.45
Dec. 6	2.26	0.57	0.70	0.90	1.26			1.04	0.91	0.84	1.65
Dec. 10	1.96	0.73	0.82	0.95	1.08			0.87			2.26
Dec. 11	3.15	0.84	0.98	1.11	1.28			1.12	0.97	0.83	2.06
Dec. 13	4.57	0.36	0.49	0.67							5.16
Dec. 18	3.45			1.06				1.09	0.97	0.82	2.49
Dec. 19	3.45	0.88	0.95	1.15	1.35			1.18	1.00		2.74
Dec. 21	1.88	0.92	1.04	1.19	1.38			1.10	0.96		1.12
Dec. 22	1.88			0.71	0.82						1.37
Dec. 26	3.81			0.60	0.77						3.81
Means		0.72	0.83	0.96	1.16			1.04	0.92	0.83	
Departures		−0.06	−0.06	−0.08	−0.07			+0.01	+0.01	+0.04	
Madison, Wis.											
Dec. 21	0.74		1.12	1.31							0.96
Means			(1.12)	(1.31)							
Departures			+0.02	+0.09							
Lincoln, Nebr.											
Dec. 4	1.60							1.14	1.07	0.95	1.68
Dec. 5	2.16	0.90	1.04	1.16	1.22						2.16
Dec. 6	2.87		0.95	1.19	1.38			1.03	0.87		2.62
Dec. 19	2.06	1.14	1.22	1.35	1.49						1.37
Dec. 22	3.45			1.14	1.33			1.11	1.02		3.81
Dec. 24	3.81		1.01	1.20				1.22	1.13	0.99	3.99
Dec. 26	3.00							1.02	0.90	0.82	3.15
Dec. 27	4.37	0.95	1.07	1.14							3.15
Dec. 29	2.74	1.03	1.15	1.26							3.15
Means		1.00	1.07	1.21	1.36			1.10	1.00	0.92	
Departures		−0.05	±0.00	−0.01	−0.02			−0.09	−0.07	−0.04	

[1] Extrapolated.

TABLE 2.—*Solar and sky radiation received on a horizontal surface*

[Gram-calories per square centimeter of horizontal surface]

Week beginning	Average daily radiation					Average daily departure from normal		
	Washington	Madison	Lincoln	Chicago	New York	Washington	Madison	Lincoln
1928	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*
Dec. 3	190	136	210	95	77	+45	+12	+37
10	122	73	84	49	95	−18	−44	−82
17	136	116	152	80	94	−6	−8	−13
24 [1]	120	109	182	79	94	−23	−20	+8
Deficiency at end of year						−1,740	−906	−2,260

[1] 8-day period.

POSITIONS AND AREAS OF SUN SPOTS

[Communicated by Capt. C. S. Freeman, Superintendent U. S. Naval Observatory. Data furnished by Naval Observatory, in cooperation with Harvard, Yerkes, and Mount Wilson Observatories. The differences of longitude are measured from central meridian, positive west. The north latitudes are plus. Areas are corrected for foreshortening and are expressed in millionths of sun's visible hemisphere. The total area, including spots and groups, is given for each day in the last column]

Date	Eastern standard civil time	Heliographic			Area		Total area for each day
		Diff. long.	Longitude	Latitude	Spot	Group	
1928	*h. m.*	°	°	°			
Dec. 1 (Mount Wilson)	11 00	−68.0	250.6	+11.0	8		
		−61.0	257.6	−15.0	174		
		−50.0	268.6	+9.0		459	
		−27.0	291.6	+14.0	3		
		−17.0	301.6	+9.0		4	648
Dec. 2 (Naval Observatory)	11 42	−47.5	257.6	−16.5	123		
		−39.5	265.6	+9.0		463	
		−2.0	303.1	+8.0		31	
		−1.0	304.1	+22.0		62	
		+0.5	305.6	−2.5	6		685
Dec. 3 (Naval Observatory)	11 41	−35.0	256.9	−16.5	123		
		−26.0	265.9	+8.5		772	
		−7.5	284.4	+10.0	6		
		+11.0	302.9	+8.0	9		
		+13.0	304.9	+22.0		46	956
Dec. 4 (Naval Observatory)	11 41	−42.5	236.3	−11.5		123	
		−21.5	257.3	−17.5	123		
		−12.0	266.8	+8.5		833	
		+27.5	306.3	+21.0		46	1,125
Dec. 5 (Naval Observatory)	11 45	−28.5	237.1	−11.5		247	
		−8.5	257.1	−17.5	123		
		+0.5	266.1	+8.0		1,049	
		+40.0	305.6	+21.0		31	1,450
Dec. 6 (Naval Observatory)	11 49	−79.0	173.3	−11.5		154	
		−15.5	236.8	−11.5		231	
		−7.0	245.3	+11.5		46	
		+4.0	256.3	−17.5	123		
		+14.5	266.8	+8.0		988	1,542
Dec. 7 (Mount Wilson)	14 00	−67.0	171.0	−9.0	63		
		−63.0	175.0	+20.0	4		
		−2.0	236.0	−10.0		251	
		+18.0	256.0	−18.0	126		
		+30.0	268.0	+8.0		530	974
Dec. 8 (Naval Observatory)	9 57	−52.5	174.5	−11.5		93	
		+10.0	237.0	−11.5		278	
		+29.5	256.5	−17.5	123		
		+40.0	267.0	+8.0		848	1,342
Dec. 9 (Naval Observatory)	12 23	−78.0	134.5	+14.0	31		
		−39.5	173.0	−11.0		108	
		−37.5	175.0	+18.0		31	
		−22.5	190.0	+15.0	15		
		+24.0	236.5	−11.5		432	
		+42.5	255.0	−17.0	123		
		+56.0	268.5	+7.5		910	1,650
Dec. 10 (Naval Observatory)	11 52	−88.0	111.6	+14.5	154		
		−65.5	134.1	+14.0	31		
		−29.0	170.6	−17.0	12		
		−27.0	172.6	−11.0		154	
		−24.0	175.6	+18.5		62	
		−23.5	176.1	+12.0		46	
		+37.5	237.1	−11.5		370	
		+56.0	255.6	−17.0	139		
		+70.5	270.1	+7.5		1,173	2,141